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Case Report

Delayed presentation of ventricular septal defect secondary to penetrating cardiac trauma following stab wound to the chest

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Abstract

Ventricular septal defect represents an uncommon sequel of penetrating cardiac trauma. A high index of suspicion, follow-up, and a complete evaluation of the patient who survives a penetrating heart injury is required. We report an unusual case of posttraumatic ventricular septal defect in a patient who had a stab injury to the chest requiring emergency operation. After the first surgery, the patient presented with dyspnea and signs of heart failure. Intraoperative assessment revealed ventricular septal defect.

KEY WORDS: Heart injuries, diagnosis, ventricular septal defect, penetrating wounds.

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Penetrating cardiac trauma is typically life-threatening and often requires emergency operative intervention. With improved trauma care, an increasing number of these patients arrive at the hospital alive [1]. However, in a review of 1,198 cases of penetrating cardiac trauma from South Africa, only 6% of patients arrived at hospital alive [2]. Penetrating injury can rarely cause damage in more than one cardiac chamber that may be difficult to identify at initial emergent operation [3,4].

Case presentation

In January 2007, a 25-year-old man, with no medical history, was stabbed with two stab wounds to the left anterior hemithorax and upper abdomen. After 1 hour, he was admitted with syncope and confusional state to the emergency service of another hospital. He was hospitalized in a severe state of shock. Evaluation revealed a blood pressure of 70/45 mmHg, a pulse rate of 130 beats/min, and a respiratory rate of 28 breaths/min. Physical examination at that institution revealed decreased breathing sounds in left hemithorax and tenderness in upper abdominal region. Chest radiography showed a left-sided haziness and collection from which an inserted chest tube drained 800 cc of blood. The electrocardiogram showed sinus tachycardia and nonspecific ST-T changes. After resuscitation, he was taken to the operating room. Emergency thoracotomy was performed and revealed a perforation in right ventricular free wall just beneath the pulmonary valve with large amount of cloth in pericardial cavity. The perforation was repaired with direct suture closure using Teflon pledgets. No other cardiac injury was noted at the time of that operation. Exploratory laparatomy was also done and a small tear in diaphragm was repaired. Other abdominal organs were normal. Six hours after operation, he was extubated but developed severe dyspnea associated with signs of heart

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failure a few hours later. Chest radiography showed pulmonary congestion with interstitial lung edema. He was transferred to our hospital for further assessment.

Two-dimensional transthoracic echocardiography (TTE) revealed right ventricular (RV) and right atrial (RA) dilatation with elevated pulmonary artery pressure (PAP=50 mmHg) (figure 1). According to TTE, there was a suspicion about existence of either mitral valve regurgitation or ventricular septal defect (VSD) due to residual trauma. He was scheduled for emergency open heart surgery because of rapid deterioration of his condition. A standard median sternotomy was performed, and cardiopulmonary bypass with moderate hypothermia was instituted using aortobicaval cannulation and antegrade administration of blood for cardioplegia. Inspection of the intraventricular cavity revealed a supracristal VSD (about 1.5 cm in size) (figure 2), which was repaired with a few sutures using Teflon pledgets and RV was closed with a small pericardial felt. Intraoperative TEE showed no residual left-to-right shunt or mitral regurgitation. Cardiopulmonary bypass was terminated with high inotropic support and intra-aortic balloon pump (IABP). IABP was removed 24 hours post-operatively and extubation was performed 5 days later. The patient was discharged from the hospital on the 14th postoperative day. At a 3-month clinical follow-up, repeat echocardiography showed good LV and RV function without any residual shunt and he was doing well, without dyspnea or activity limitation.

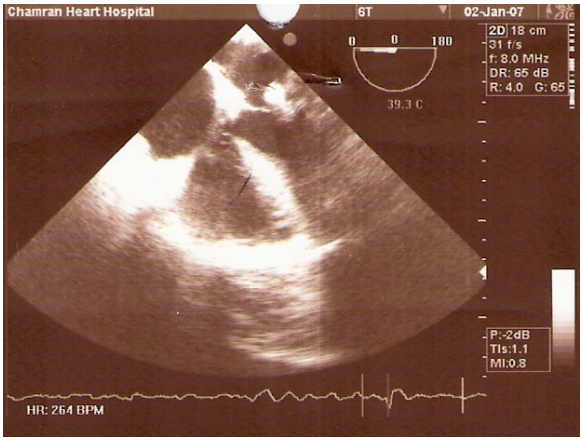

Figure 1. Two-dimensional echocardiography shows RV and RA dilatation.

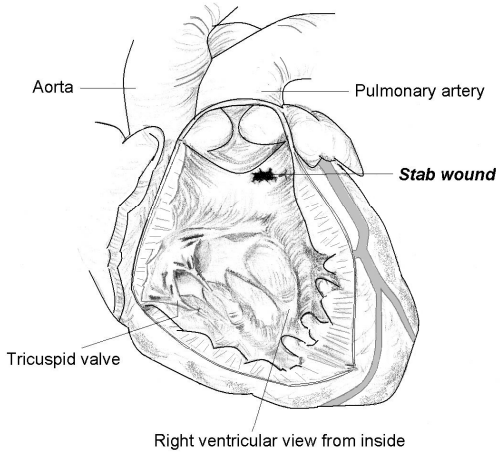

Figure 2. Intraoperative schematic view of ventricular septal defect.

Discussion

Only 6% of all penetrating cardiac trauma victims can reach an emergency department alive and of those only 50% manage to survive. The most common causes of penetrating cardiac injuries are stabbings (up to 60%) and gunshot wounds [5]. Such injuries may result in valve dysfunction, septal defects, aorto-pulmonary artery fistulae, coronary artery injuries and fistulae, ventricular aneurysms, pericarditis, electrocardiographic changes, endocarditis and tamponade. These patients can be hemodynamically unstable, rendering initial exploration difficult [6]. Once a secondary complication is suspected, the continued evaluation may include serial examinations, electrocardiograms, echocardiography, radionuclide scintigraphy, and right and left heart catheterizations. Cardiopulmonary bypass is only occasionally required acutely in the management of penetrating cardiac injuries, usually to allow coronary grafting [7]. The incidence of VSD occurs in up to 4.5% of penetrating cardiac trauma [8]. The mechanism of VSD can be either a direct trauma to interventricular septum or as a complication of myocardial infarction resulting from an injury to a coronary artery. Pericardial effusion often accompanies the clinical picture as a penetrating trauma also traverses the ventricular free wall [5]. Transesophageal echocardiography is probably the most sensitive test for characterizing such injuries, although the septal perforation in our patient was not found until operation [9]. Additionally, in some patients with severe hemodynamic compromise, there may not be sufficient time for echocardiography. Because our patient had undergone urgent surgery at another institution, which lacked TEE, we had to perform a 2nd reparative surgery.

Generally, a left anterolateral thoracotomy in the 5th intercostal space, which provides very rapid access to the right and left ventricles and to the pulmonary artery, is the incision of choice in hemodynamically unstable patients. However, in stable patients or in patients with gunshot wounds, which frequently involve multiple cardiac chambers, median sternotomy is the strongly favored approach. In such cases, median sternotomy, with its provision of much better surgical exposure, enables the surgeon to perform a comprehensive evaluation and repair of nearly any damaged intracardiac part [3]. VSDs can shrink or even spontaneously close with time; however they can also widen in time and result in clinical deterioration. Surgical or transcatheteric closure is recommended for post-traumatic VSDs if left to right shunt ratio is >1.5 or if congestive heart failure develops [5]. Hemodynamically insignificant, isolated VSDs with a low left-to-right shunt ratio can be followed up with echocardiography. Suspicion of intracardiac injury is usually raised by persistent hemodynamic instability or the incidental discovery of a cardiac murmur. Many of these lesions become clinically detectable only at a later stage, sometimes weeks later, when the defect has become larger after resolution of surrounding edema, lyses of an occluding clot, fibrous retraction of the edges, or ventricular enlargement. For the same reasons, detection of such defects at the time of initial evaluation can be extremely difficult, even with TEE [3].

Conclusions

In conclusion, patients sustaining penetrating trauma to the heart should undergo thorough investigation for multiple intracardiac injuries. In addition to the free wall of the heart or the great arteries, penetrating cardiac injury may involve the interventricular and interatrial septa, cardiac valves, conduction system, and coronary arteries. Since little time and little diagnostic information are available before an urgent operation, patients with penetrating cardiac injuries may require additional surgery to repair injuries not found during the acute stabilization process [3]. Cardiac catheterization and routine intraoperative transesophageal echocardiography will identify most intracardiac injuries, but the surgeon should examine the valves and septa intraoperatively [9].

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